

WHAT IS CLAIMED IS:

1. A metal particle-dispersed composite oxide comprising:

a matrix material containing a composite oxide comprising a non-reducible metal oxide and an easily reducible metal oxide, the composite oxide containing 0.01 to 0.25 mol% of at least one additive metal selected from Al, Sc, Cr, B, Fe, Ga, In, Lu, Nb and Si; surface metal particles precipitated on an outer surface of the matrix material containing the composite oxide; and

inner metal particles precipitated on an inner surface of the matrix material containing the composite oxide.

15 2. The metal particle-dispersed composite oxide according to claim 1, wherein a volume fraction of the inner metal particles is 0.01% to 1%.

3. The metal particle-dispersed composite oxide according to claim 1, wherein an average particle 20 diameter of the surface metal particles is 10 nm or more.

4. A metal particle-dispersed composite oxide-sintered body comprising:

a metal particle-dispersed composite oxide 25 existing in a region of the sintered body extended from the surface thereof to a depth of 10 μm , the metal particle-dispersed composite oxide including a matrix

material containing a composite oxide comprising a non-reducible metal oxide and an easily reducible metal oxide, the composite oxide containing 0.01 to 0.25 mol% of at least one additive metal selected from Al, Sc,

5 Cr, B, Fe, Ga, In, Lu, Nb and Si;

surface metal particles precipitated on an outer surface of the matrix material containing the composite oxide; and

10 inner metal particles precipitated on an inner surface of the matrix material containing the composite oxide.

15 5. The metal particle-dispersed composite oxide-sintered body according to claim 4, wherein a volume fraction of the inner metal particles in the metal particle-dispersed composite oxide is 0.01% to 1%.

20 6. The metal particle-dispersed composite oxide-sintered body according to claim 4, wherein an average particle diameter of the surface metal particles in the metal particle-dispersed composite oxide is 10 nm or more.

7. A method of manufacturing a metal particle-dispersed composite oxide comprising:

25 mixing a powder of a non-reducible metal oxide, a powder of an easily reducible metal oxide and a powder containing at least one additive metal selected from Al, Sc, Cr, B, Fe, Ga, In, Lu, Nb and Si to obtain a mixed powder containing the additive metal at a ratio

of 0.01 to 0.25 mol%;

molding the mixed powder into a molded body;

sintering the molded body to obtain a sintered body formed of a composite oxide comprising the non-reducible metal oxide and the easily reducible metal oxide; and

subjecting the sintered body to a reducing treatment to precipitate particles of the easily reducible metal oxide on a surface of the composite oxide.

8. The method according to claim 7, wherein the powder of a non-reducible metal oxide includes a carbonate hydroxide compound phase.

9. The method according to claim 7, wherein the powder of a non-reducible metal oxide includes not less than 5% by weight of a carbonate hydroxide compound phase.

10. A method of manufacturing a metal particle-dispersed composite oxide sintered body comprising:

20 preparing a couple of green sheets each containing a powder of a non-reducible metal oxide, a powder of an easily reducible metal oxide and an organic binder;

preparing a carbon slurry containing carbon, an easily reducible metal oxide and a binder;

25 coating the carbon slurry on one major surface of one of the green sheets to form a carbon slurry layer having a pattern of channel;

laminating the other one of the green sheets on the one of green sheets having the carbon slurry layer formed thereon and pressing these green sheets together to obtain an integrated green body;

5 eliminating the binder from the green body;

 burning the carbon included in the carbon slurry layer to obtain a channel pattern;

 sintering the green body having the channel pattern to obtain a sintered body; and

10 subjecting the sintered body to heat treatment in a reducing gas atmosphere to reduce the easily reducible metal oxide to precipitate metal particles in a form of the channel pattern.

11. A method of manufacturing a metal particle-dispersed composite oxide sintered body comprising:

 preparing three green sheets each containing a non-reducible metal oxide, an easily reducible metal oxide and an organic binder;

20 forming a pattern of channel in one of the green sheet by punching;

 interposing the green sheet having the channel pattern formed therein between the remaining couple of the green sheets and pressing these green sheets together to obtain an integrated green body;

25 cutting the integrated green body into a predetermined size to expose ends of the channel pattern;

eliminating the binder from the green body;

sintering the green body eliminated of the binder to obtain a sintered body; and

subjecting the sintered body to heat treatment
5 in a reducing gas atmosphere to reduce the easily
reducible metal oxide to precipitate metal particles in
a form of the channel pattern.

12. A method of manufacturing a metal particle-dispersed composite oxide sintered body comprising:

10 preparing a couple of sheets each formed of a non-reducible metal oxide and having a first major surface and a second major surface;

forming a fluid passage groove on the first major surface of each of the sheets;

15 forming a layer of an easily reducible metal on a surface of the fluid passage groove;

laminating the couple of sheets each other with the first major surfaces of these sheets being contacted with each other to obtain a laminate;

20 subjecting the laminate to heat treatment to occur diffusion solid solution between the non-reducible metal oxide and the easily reducible metal to form a diffusion solid solution layer; and

subjecting the heat-treated laminate to heat treatment in a reducing gas atmosphere to reduce the easily reducible metal included in the diffusion solid solution layer to precipitate particles of the easily

reducible metal in the fluid passage groove.

13. A hydrocarbon fuel reformer comprising:

a fuel tank accommodating a hydrocarbon fuel;

a reforming agent tank accommodating a reformer

5 for reforming the hydrocarbon fuel;

a preliminary heater vaporizing the hydrocarbon fuel and the reforming agent;

a mixer mixing the vaporized hydrocarbon fuel and the vaporized reforming agent;

10 a reformer having a catalyst layer containing a reforming catalyst occurring a reaction in a mixed gas obtained from the mixer to reform the mixed gas into a fuel mainly comprising hydrogen gas, the reforming catalyst being formed of metal particles-dispersed composite oxide of claim 1; and

15 a heater heating the reformer.

14. The hydrocarbon fuel reformer according to claim 13, wherein a volume fraction of the inner metal particles in the metal particle-dispersed composite oxide is 0.01% to 1%.

20 15. The hydrocarbon fuel reformer according to claim 13, wherein an average particle diameter of the surface metal particles in the metal particle-dispersed composite oxide is 10 nm or more.